

REMARKS

Favorable reconsideration in view of the previous amendments and following remarks is respectfully requested.

Claims 2-8, 15, 16, 18-35, and 40-42 are pending. By this Amendment, claims 4, 5, 15, 22, 40 and 41 are amended. No new matter has been added.

The Office Action indicates that newly amended claims 22-35 are directed to an invention that is independent or distinct from the invention originally claimed. Claim 22 is amended to properly reflect that in the course of processing the polycondensate is melted and later solidified. Claim 22, as amended, now more closely conforms to claim 22 as filed in International Application WO 03/022550. Withdrawal of the restriction requirement is respectfully requested.

The Office Action objects to the drawings. In particular, the Examiner indicates that feature 7 is not described in the specification. Further, the Examiner indicates that newly amended paragraph [0015] of the specification refers to the smooth wedge surfaces being 2 and Az. Paragraphs [0006] and [0015] are amended to clarify that smooth lateral area Am refers to element 2 and the smooth wedge surface Az is element 7. The Examiner objects to the drawings for failing to show the screw elements. In response, the phrase "screw elements" is used in the attached article "Design of Tightly Intermeshing Co-Rotating Twin Screw Extruder." See e.g. p. 11, last paragraph, right-hand column. The phrase "screw elements" is known to the ordinarily skilled artisan as shown by the article. Withdrawal of the objections to the drawings is respectfully requested.

The Examiner argues that the recitation in the claims of the screw elements being flighted and that feature 2 being the wedge surface is new matter. As

discussed above, the specification has been amended to clarify that the smooth lateral area Am is element 2.

As previously argued, support for the feature of the flighted screw elements can be found in German Applications 10144748.5 and 1024117.4 from which this application claims priority and whose contents have been incorporated by reference. See the term zweigängiges Schneckenelement (twin flighted screw elements) and dreigängiges Schneckenelement (triple flighted screw elements) disclosed throughout DE 101 44 748. See e.g. claim 1 or paragraph [0013].

As stated in MPEP §201.13, elements described in a foreign priority application whose contents have been incorporated by reference are not new matter. Withdrawal of this objection is respectfully requested.

The Examiner continues to assert that the term Di is not supported by the original disclosure. However, support for this is provided in paragraph [0006] of the specification which states that Di is the inner diameter of the screw. Applicants note that the term internal modifies the term diameter. The term diameter refers to an external feature. The same term Di is used in the cited art, U.S. Patent No. 6,042,260 to Heidemeyer et al. and referred to as a screw inner diameter. Obviously, this is a term known to the ordinarily skilled artisan.

The Examiner states there is no support for Am being part of the process space as shown in Figure 2. However, Am, element 2, is described in paragraph [0006] of Applicants' specification as being a smooth lateral area and should not be confused with the process space.

The Office Action rejects claims 40-42, 2-8, 15, 16 and 18-35 under 35 U.S.C. §112 first paragraph as providing no support for "twin flighted screw elements". As previously discussed support for the feature of the twin flighted screw elements can be found in the priority applications. The term "elements" is explained in the attached article.

The Examiner argues there is no support for Di being the inner diameter of a screw base. As discussed above, the term Di used in the application and in the cited art is a term known to the ordinarily skilled artisan and corresponds to a diameter of the screw and not an internal shaft.

The Office Action rejects claim 16 as having no support for the limitation that the screws are tightly intermeshed. Support for this feature can be found in paragraph [0024] of the as-filed specification. Applicants note that the phrase "dense comb" has been amended to recite "tightly intermeshing" which is the correct technical translation of the as-filed German term dichtkämmend in WO-03/022550 (p. 5, last paragraph). Further, the attached article demonstrates that the phrase "tightly intermeshing" is known to the ordinarily skilled artisan. The phrase tightly intermeshing is a phrase commonly used for extruders and implies a small tolerance between two screws which when rotating do not touch but provide a small enough distance to provide substantial cleaning of each surface.

The Examiner indicates that there is no support for the phrase "self-cleaning screws" of claim 40. This feature is clearly disclosed in paragraphs [0006] of the as-filed specification and [0015], each of which recites self-cleaning screws.

The Office Action rejects claims 40-41, 2-8, 15, 16, and 18-35 under 35 U.S.C. § 112, second paragraph. Claims 15 and 41 are amended to address the Examiner's concerns with regard to antecedent basis issues.

With respect to claim 4, the claims are amended to recite that Da/Di is from 1.5 to 1.63 and that the twin flighted screw elements have that value. It is clear that this is a single value within a range.

The Office Action indicates that there is confusing antecedent basis for the phrase "screw elements" in claim 5. Claim 5 is amended to clarify this feature.

The Office Action indicates that the phrase "screw elements" is indefinite. The phrase "screw elements" is used throughout the article described above and demonstrates that the phrase is known to the ordinarily skilled artisan.

The Examiner indicates that the element Az is confusing because it includes a non-existent phantom surface. Az 7 is the wedge area (active kneading area between the screws). This designates an area on the surface of two interacting screws. The reference numbers are used for a three dimensional geometry, whereas the drawings are two dimensional. Therefore, the designations for the features 2, 7, 8 extend into the longitudinal direction. This is known to the ordinarily skilled artisan. See e.g. Booy cited at paragraph [0058] of Applicants' published specification.

The Examiner indicates that claim 6 is an improper Markush group. Claim 6 is amended to address the Examiner's concerns.

The Office Action rejects claims 40, 2-5, 15, 16, 42 and 18-21 under 35 U.S.C. § 102(b) or in the alternative under 35 U.S.C. § 103(a) over U.S. Patent No. 6,042,260 to Heidemeyer.

DE 19536289 described in paragraphs [0002] and [0003] of Applicants' as-filed specification corresponds to the Heidemeyer patent.

As described therein, the method of Heidemeyer can be used for the processing of plastics, in particular resins and viscoplastic masses, on a twin shaft extruder. To minimize thermal, thermochemical and mechanical impairment of product quality during processing, the residence time of the product in the extruder is kept short. This is achieved by using a high number of rotation speeds in combination with high torque densities to process a high volume of throughput. At the same time the high free volume (processing space volume) in the extruder remains unchanged. However, the resulting mechanical and thermal stress on the product can lead to unacceptably high product damage, in particular in the case of processing polycondensates such as polyesters, elastomers, for example, rubber mixtures.

Applicants' independent claim 40 recites, in combination with other claimed features, a method for preparation of a product comprising rotating at least four individually driven, self-cleaning screws of a multi-shaft extruder having twin flighted screw elements in a common direction about their own axes. At least one part of the process space is formed having a lateral surface area A_m formed by a smooth hole surface and a free volume V_f formed between each screw and the hole surface. The process space formed by the lateral area A_m and the free volume V_f has a ratio A_m^3/V_f^2 between 1020 and 3050 for twin flighted screw elements at a D_a/D_i ratio of 1.3 to a D_a/D_i ratio of 1.7. Such features provide advantages for shear sensitive products, for example, polycondensates or elastomers.

To address the problem of high shear over a long time causing excessive degradation, the Heidemeyer patent uses a high screw speed to reduce the amount of time of processing. However, high screw speeds lead to very high peak values for shear. Although the average shear per process material is smaller, peak values are not acceptable for many materials. Applicants' independent claim 40 reduces the free volume which reduces resonance time and therefore the degradation of the material. There is no need to increase screw speed and therefore excessive peak shear is prevented. Thus, the features of the process space formed by the lateral area A_m in the free volume V_f having a ratio A_m^3/V_f^2 between 1020 and 3050 for twin flighted screw elements at a ratio of D_a/D_i 1.3 to a D_a/D_i ratio of 1.7 is not disclosed by the Heidemeyer patent.

Applicants' dependent claims are allowable for at least the reasons discussed above as well as for the individual features they recite. For example, dependent claims 2 and 3 recite a torque density of at least 7 Nm/Cm³ and 9 Nm/Cm³ respectively. However, combining the characteristics of Applicants' independent claim 40 with a higher torque allows a reduction in screw speed and thus provides further advantages not disclosed in the Heidemeyer patent nor would it have been obvious to the ordinarily skilled artisan.

Dependent claim 18 recites controlling the temperature of a core in a housing, wherein the core and housing are both stationary. Typically, only the barrel is temperature controlled and the core reaches a temperature as a result of the processed product. Thus, such a feature would not have been obvious to the ordinarily skilled artisan.

Early and favorable action with respect to this application is respectfully requested.

Should the Examiner have any questions regarding this amendment or the application in general, he is invited to contact the undersigned at the number provided below

Respectfully submitted,

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